

QUESTIONS From the Cosmology Workshop:

- 1) What is the relationship between dark energy & matter?
- 2) How do stars pass through each other?
- 3) What is the significance of  $1/R^2$  ? Where are all the places we have seen this?
- 4) What is a giga? Google? mega? tera? nano? micro?
- 5) How do the speeds of the furthest out planets in our solar system compare to the closest in planets? How do the speeds of the furthest out stars in a galaxy compare to the closer in stars? Explain.
- 6) Remembering the activity with the balls and calculating gravity, what would the graphs etc. look like if we had negative gravity? How does that relate to Dark Energy? How is dark energy repulsive?
- 7) What are the 4 phases of matter? Which is the most common in the Universe? Where do we see that phase on earth?
- 8) How do we know when the expansion of the Universe started to accelerate?
- 9) What are the 4 forces? Which ones does Dark Matter appear to "feel"? Why do scientists believe this?
- 10) Are time, distance, and wavelength always constant????
- 11) What happened/ existed before the big bang? What caused the big bang? How do we know all this?
- 12) Discuss inflation. What is it? What caused it?
- 13) What caused the expansion rate of the Universe to slow down after inflation?
- 14) Since the 2.7 K CMB is evidence of the Big Bang, how did scientists know the original wavelength & temperature of these waves?
- 15) What causes the Dark Ages?
- 16) We have done Hubble diagrams with recent data and very distant galaxies. We are now trying to connect that to the graph of the Expansion History of the Universe. Could you go over the graph explaining the different curves, and also the labels of deceleration & acceleration?
- 17) What are a Closed, Flat, and Open Universe? Do they relate to the Expansion History of the Universe graph?
- 18) How do you calculate the number of photons? Atoms? In the Universe?
- 19) Potential energy vs. Dark energy?
- 20) What are Acoustic Oscillations? How do they relate to waves? Dark matter? Standard Ruler?
- 21) At what time in the Universe would the conditions be stable enough for basic life to begin? What is the possibility that an advanced civilization could have formed far before the first single-cell developed on Earth?
- 22) How long will it be before we find extraterrestrial life that we can procreate with? Would it even be possible?
- 23) What happens when light reaches the end of the universe?
- 24) How can galaxies shift away if the universe is finite?
- 25) What's the average time it takes for type Ia supernovae to reach their maximum luminosity?
- 26) Black holes? Singularities? Star life?
- 27) Was the speaker talking about the visible universe when he gave us the figures-  $7.46 \times 10^{79}$  atoms &  $10^{89}$  photons?
- 28) What does it mean when dark matter splits from ordinary matter?
- 29) How do we know that the universe is finite?
- 30) If the universe is finite, how could galaxies be getting farther away from each other?

- 31) What caused differentiation?
- 32) How does a cyclotron work?
- 33) What is Bose-Einstein condensation?